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Impaired Recognition of Positive Emotions in Individuals with Posttraumatic Stress Disorder, Cumulative Traumatic Exposure, and Dissociation

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Reading other people's emotions is an essential human skill that is impaired in several clinical populations [1]. Only 1 previous study has assessed emotion recognition (ER) in individuals with posttraumatic stress disorder (PTSD) [2], revealing impaired recognition of fear and sadness. However, Poljac et al. [2] examined only male combat veterans, using artificially produced (morphed) stimuli. Thus, it is unknown whether individuals suffering from non-war-related PTSD show ER deficits and which factors contribute to the observed deficits. One potential factor might be the presence of dissociative symptoms during ER, which might make it difficult to focus on and interpret emotional stimuli. Furthermore, trauma history (childhood trauma, or number of lifetime experienced traumatic events, NOET) might be linked to ER deficits by hindering learning processes during childhood, e.g. due to a lack of expressed and/or positive emotions by caregivers. On the other hand, individuals exposed to repeated trauma may learn to detect expressions pointing to potentially harmful situations more quickly [3] and/or accurately.

We aimed at extending initial findings on ER [2] to individuals with PTSD following various trauma types. While previous research used static images or computer-generated videos, we used short video sequences showing actors' emotional expressions of different intensities, reflecting everyday life situations. Additionally, we explored the relationship between ER and childhood trauma, NOET, and dissociation. Next to recognition accuracy, we assessed reaction times, based on some evidence of diminished response times for recognition of negative expressions in traumatized individuals, which might indicate biased cognitive processing [3].

We examined 39 PTSD participants, 44 traumatized healthy controls (TC), and 35 non-traumatized healthy controls (HC), 18–65 years of age, with (corrected to) normal vision and high German proficiency. Exclusion criteria comprised lifetime psychotic symptoms, verbal IQ <70, acute suicidality, substance use disorders (past year), medication with strong effects on the autonomous nervous system, major somatic illness, and (for controls) current mental disorder. Mean age (37.3 years, SD = 11.7) and percentage of female participants (71%, $n = 84$) did not differ between groups. PTSD participants met DSM-5 PTSD diagnostic criteria (index trauma: 95% man-made, 64% type II, i.e. long-standing or repeated); 72% ($n = 28$) had comorbid mental disorders. TC experienced at least 1 DSM-5 trauma (index trauma: 82% man-made, 11% type II). HC participants reported no traumatic events.

After the diagnostic interview which included the German version of the Posttraumatic Diagnostic Scale, the Clinician-Administered PTSD Scale for DSM-5, the Mini International Neuropsychiatric Interview, and self-report measures of childhood trauma, NOET and severity of depressive symptoms, participants (same day or within 1 week) watched 300 filmed emotion expressions displayed by 5 male and 5 female models at low, intermediate, and high intensity levels (from the Amsterdam Dynamic Facial Expression Set – Bath Intensity Variations [4]; adaptation of the Amsterdam Dynamic Facial Expression Set [5]). Each video lasted 1 s and showed a neutral expression, changing into joy, anger, fear, sadness, surprise, disgust, contempt, pride, embarrassment, or remaining neutral. Participants had to identify the presented emotion as quickly as possible by clicking on a corresponding field. Thereafter, dissociative symptoms during the task were self-reported using the Responses to Script-Driven Imagery Scale (RSDI, only the dissociative symptoms subscale) [6].

Generalized estimating equation analyses were conducted regarding the primary (number of correct responses; binomial distribution, logit link; unstructured correlation matrix, model-based estimators) and secondary outcome measures (response time; gamma distribution, log link; unstructured correlation matrix, model-based estimators), with valence (positive: joy, pride; negative: anger, fear, sadness, disgust, contempt, and embarrassment) and intensity (low, intermediate, and high) as within-subject factor and group (PTSD, TC, HC) as between-subject factor. Post hoc marginal mean comparisons were Bonferroni-Holm-corrected. To estimate the impact of state dissociation (RSDI), childhood trauma (Childhood Trauma Questionnaire, CTQ) [7] and NOET on the outcomes despite substantial correlations with the diagnostic group, we additionally conducted the described

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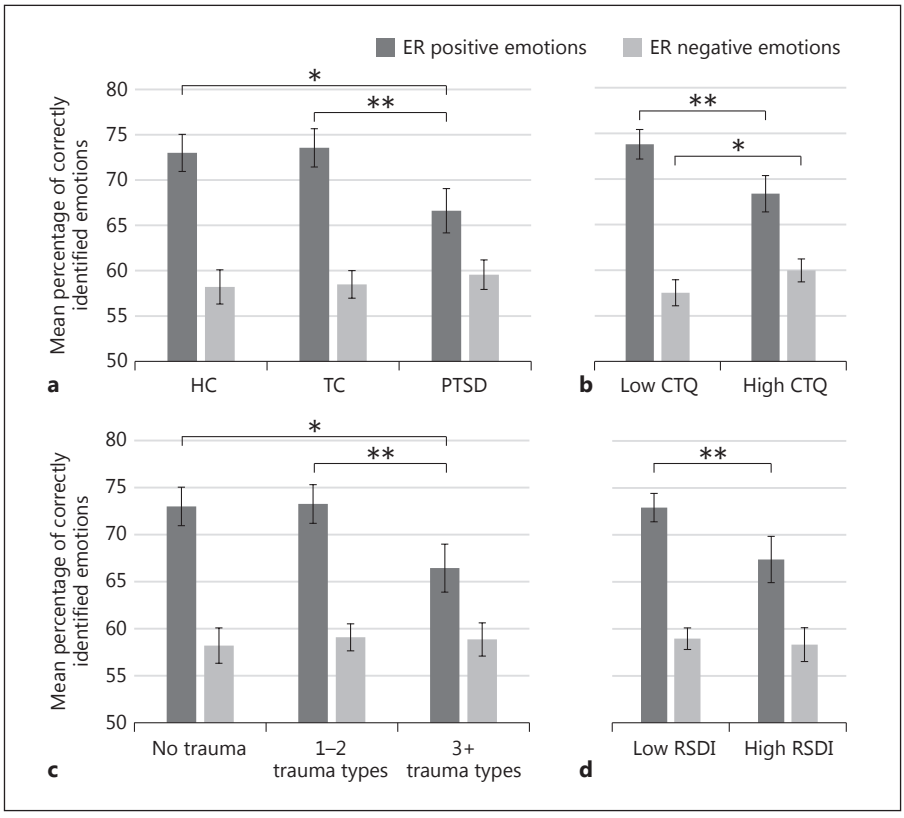

Fig. 1. Emotion recognition (ER; percentage of correctly identified emotions) based on different group categories. Error bars represent standard errors; ** $p = 0.01$, * $p = 0.05$. **a** HC, non-traumatized healthy controls; TC, traumatized healthy controls; PTSD, posttraumatic stress disorder group. **b** Low CTQ, group with lower Childhood Trauma Questionnaire scores; high CTQ, group with higher Childhood Trauma Questionnaire scores. **c** No trauma, participants who had never experienced any trauma; 1–2 trauma types, participants who experienced 1 or 2 different trauma types; 3+ trauma types, participants who experienced 3 or more different trauma types. **d** Low RSDI, group with lower Responses to Script-Driven Imagery Scale scores; high RSDI, group with higher Responses to Script-Driven Imagery Scale scores.

analyses using groups based on median/quantile splits of these measures (high and low for CTQ (median = 38.5)/RSDI (median = 0.5); no trauma, 1 or 2 trauma types, 3 or more trauma types for NOET) and compared the corresponding model fits (the corrected quasi-likelihood under independence model criterion).

PTSD individuals performed more poorly than TC ($p = 0.006$) and HC ($p = 0.034$) at detecting positive emotions (Fig. 1). Recognition of positive emotions was unrelated to depression severity within each group (r values <0.124, p values >0.481) and did not differ between PTSD participants with ($n = 23$) and without major depression ($n = 16$; $p = 0.338$). The high RSDI, CTQ, and NOET groups underperformed in recognizing positive emotions compared to the low RSDI, CTQ, and NOET groups, and these models showed improved statistical model fits over the standard model based on diagnostic groups (Table 1). In the NOET model, this effect was found for the group with 3 or more trauma types (compared to the 2 other groups) and restricted to low and intermediate intensity expressions (group × valence × intensity interaction). The high CTQ group outperformed the low CTQ group in recognizing negative emotions. Reaction time analyses revealed no group main effects or interactions.

Due to avoidance and social withdrawal, PTSD individuals likely have fewer positive encounters, which may result in less detailed and accessible representations of positive expressions, interfering with ER [8]. In line with a link found between poorer recognition of positive (and neutral) images and childhood trauma but not PTSD [9], our study suggests that trauma history might be related to impaired recognition of positive expressions

Table 1. Model fit (corrected quasi-likelihood under independence model criterion, QICC) and effect statistics (Wald χ^2) for models with alternate grouping variables

GV	QICC	GV	GV × intensity	GV × valence	GV × intensity × valence
Accuracy					
Group	92,684.04	4.72	8.20	18.70*[p]	3.18
CTQ	92,238.71	1.41	11.53*	19.31*[p/n]	4.66
RSDI	92,296.65	16.52*	12.59*[l/m]	14.39*[p]	0.67
NOET	92,381.11	7.39	16.42*	13.75*[p]	27.27*[l/m/p]
RT					
Group	139.90	0.05	1.58	0.63	0.65
RSDI	127.72	0.16	4.66	0.24	0.05
CTQ	128.08	0.06	1.78	0.42	0.29
NOET	139.65	0.16	1.76	0.35	0.29

NOET, number of experienced trauma types; CQT, Childhood Trauma Questionnaire; RSDI, Responses to Script-Driven Imagery Scale; GV, grouping variable; RT, reaction times. * $p < 0.05$ (corrected using the Bonferroni-Holm procedure). [l] Significant group comparisons for low intensity. [m] Significant group comparisons for intermediate intensity. [p] Significant group comparisons for positive valence. [n] Significant group comparisons for negative valence.

more strongly than PTSD diagnosis. NOET and childhood trauma may share some of the mechanisms (e.g., avoidance and social withdrawal) linking them to impaired recognition of positive expressions, while other mechanisms (e.g., fewer positive interactions with primary caregivers or ambiguity of positive expressions, which for sexually abused individuals may have been followed by abuse) might be specific for childhood trauma. Our findings also show that (childhood) traumatization can be linked to *enhanced* ER abilities. Similarly, maltreated children are faster at identifying negative emotions [3], which might be an advantage in an abusive environment and is in line with an established link between speed and accuracy of facial expression recognition and frequency with which expressions occur in social encounters [8]. Our study further suggests that even moderate levels of dissociation are linked to ER deficits. Dissociative tendencies may not be associated with impaired processing (e.g., attention lapses) but with high sensitivity to emotional stimuli, followed by avoidance of further elaboration of upsetting stimuli [10]. In fact, state dissociation was linked to ER accuracy but not speed.

Our results stand in contrast to another study [2] which found impaired recognition of fear and sadness. Next to differences in experiment stimuli, inconsistent findings might be linked to cultural, trauma type and gender differences, since Poljac et al. [2] only assessed male participants from Bosnia and Herzegovina with war-related trauma.

Although our ER task shows relatively high ecological validity, future studies should assess ER in even more naturalistic settings, e.g. during social interactions. Another limitation is the difference in trauma characteristics between PTSD and TC (more type II trauma in the PTSD group).

Our study has several implications: deficits in recognizing positive emotions likely affect social interactions and the quality of therapeutic and other relationships, possibly through a perceived lack of reinforcement and reduced approach behaviour [11]. ER deficits may furthermore maintain symptoms, e.g. by reinforcing negative beliefs. Health professionals and other interaction partners might improve their relationship with the patient by communicating positive emotions through explicit (verbal) channels. Affected individuals might furthermore benefit from ER trainings showing promising results in individuals with schizophrenia and other mental disorders.

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Disclosure Statement

All authors declare no conflicts of interest.

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